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SPACE OPERATIONS SYMPOSIUM (B6)
Training Relevant for Operations, including Human Spaceflight (3)

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HARDWARE IN THE LOOP SATELLITE ENGINEERING AND OPERATIONS TRAINING.

Abstract

Many processes where humans have to be interactively involved, require a long time to train the operators successfully without risk to the processes. For example, by making use of airplane plus airfield simulators for the pilot training and confidence building. Another example is where a simulation supported power station control room is used for training, in a strategy where the trainees do not know whether a simulated version or the real power station is controlled. The same principle applies to the training processes for designers and operators of space systems, both in respect to hardware as well as software. In this paper the hardware in the loop (HIL) training philosophy for two successful implementation areas in space systems is illustrated. The first one was using the qualification versions of the major components of the Sumbandila satellite, for training nine persons new to the field of satellite engineering. They had to integrate the satellite incrementally while testing the immerging functionality progressing up to the final satellite, mounted on an air bearing. As the process proceeded, everything that does not exist yet, also forms part of the process but as a simulated version. As the integrated and functionally tested satellite progressed, less and less is simulated until for the final satellite, only the space motion dynamics is simulated and presented to the satellite sensors as apparent inputs. The trainees then had to commission the satellite by progressing from the de-tumbling after release, the sensor commissioning up to the operational imaging procedures. This included airbearing supported dwelling on a pre-determined imaging target as sensed by the satellite's own matrix camera. The same concept was involved when the ground station personnel for another (confidential customer) satellite was trained by using the fully functional qualification model of the satellite in their ground station. Even the reception of the telemetry signals could be simulated for fading, including the tracking antennas, using the real ground station mission control software. This provided the capability to provide multi pass training continuously, and not only during the few accessible passes per day. With this strategy, the confidence of both space systems designers as well as ground station operational staff is increased in an environment where the systems are not endangered.